A Systems Approach to Improving Diabetes Care

Presenters:
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Kate Lonborg, Clinical Quality Metrics Registry Program Manager, Oregon Health Authority
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Hosted by:
Oregon Health Authority Transformation Center
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Metric Background: Basic Specs

- **Overview:** Percentage of patients 18-75 years of age with diabetes who had hemoglobin A1c > 9.0% during the measurement period *(a lower score is better)*.

- **Data Source:** EHR; electronic Clinical Quality Measure (eCQM)

- **Equation:**

  Patients whose most recent HbA1c level (performed during the measurement period) is >9.0%.

  Patients 18-75 years of age with diabetes with a visit during the measurement period (diabetes is identified using the Diabetes Grouping Value Set - 2.16.840.1.113883.3.464.1003.103.12.1001).
Metric Background: Basic Specs

**Diabetes Care: HbA1c Poor Control**

Percentage of patients 18-75 years of age with diabetes who had hemoglobin A1c > 9.0% during the measurement period. A lower score is better.

**Data source:**
Electronic Health Records

**2018 benchmark source:**
2016 CCO 90th percentile

**2018 data** (N=54,664)
- Statewide change since 2017: -0.8%
- Number of CCOs that improved: 6
- Number of CCOs achieving target: 7

**Statewide**

2014: 21.8%
2015: 26.7%
2016: 25.4%
2017: 23.6%
2018: 23.4%

Lower is better

**By region**

- **Northern Coast**
  - 2018 benchmark: 22.3%
  - 2018: 22.3%
  - 2017: 23.2%
  - 2016: 24.1%
  - 2015: 24.4%
  - 2014: 24.5%

- **Willamette Valley**
  - 2018 benchmark: 21.8%
  - 2018: 21.8%
  - 2017: 22.0%
  - 2016: 22.2%
  - 2015: 23.0%
  - 2014: 24.4%

- **Eastern OR**
  - 2018 benchmark: 22.2%
  - 2018: 22.2%
  - 2017: 24.0%
  - 2016: 27.0%
  - 2015: 27.3%

- **Tri-County**
  - 2018 benchmark: 20.4%
  - 2018: 20.4%
  - 2017: 22.0%
  - 2016: 24.7%

- **Central OR**
  - 2018 benchmark: 20.9%
  - 2018: 20.9%
  - 2017: 26.2%

- **Southern OR**
  - 2018 benchmark: 24.5%
  - 2018: 24.5%

Back to table of contents.
**Metric Background: Poor Control Defined**

- **Continuous Enrollment Criteria:** None. The “eligible as of the last date of the reporting period” rule may be used to identify beneficiaries to be included in the measure.

- **NB:**
  - Only patients with a diagnosis of Type 1 or Type 2 diabetes are included in the denominator; patients with a diagnosis of secondary diabetes due to another condition are not be included.
  - Patient is numerator compliant if:
    - The most recent HbA1c level >9%;
    - The most recent HbA1c result is missing, or,
    - If there are no HbA1c tests performed and results documented during the measurement period.
  - Exclusions: Patients in hospice. Beginning in 2020 ([CMS122v8](#)), the measure steward, NCQA, added new exclusions for patients aged 66+ who (1) are living long term in an institution for 90+ days or (2) have advanced illness and frailty.
Metric Background: Evidence Base

• Diabetes is the 7th **leading cause** of death in the U.S.
• People with diabetes are at increased risk of **serious health complications**, including:
  - Vision loss
  - Heart disease
  - Stroke
  - Kidney failure
  - Amputation of toes, feet or legs
  - Premature death
• In 2012, diabetes cost the U.S. ~$245B
  - $176 billion direct medical costs
  - $69 billion reduced productivity
• Reducing HbA1c level by 1 percentage point helps reduce risk of microvascular complications by **as much as 40 percent**.

https://ecqi.healthit.gov/sites/default/files/ecqm/measures/CMS122v7.html
Addressing Poor HbA1c Control: System Based Solutions

PRESENTED BY: Andrew Ahmann, MD
Conflict of Interest

• I have the following Conflicts of Interest to report
  ⚫ Grants/Research
    o Lilly, Dexcom
  ⚫ Consultant
    o Lilly, Novo Nordisk, Medtronic

• Any non-approved medication use will be identified.
Reviewing the importance of controlling diabetes.
Diabetes Statistics

• 30.3 millions have diabetes in the US
  – 9.4% of the population
  – 12.2% of adults
• Rates higher for American Indians, Blacks and Hispanic
• 33.9% of US adults have prediabetes
• 2017 costs estimated at $327 billion in US
  – Costs are increasing rapidly (26% from 2012-2017)
• Costly complications of diabetes are decreasing but rates remain much higher than the general population.

National Diabetes Statistics Report, 2017 (CDC)
American Diabetes Association, Diabetes Care 2018; 41:917-928
Clinical Impact of Diabetes

- 2- to 4-fold increase in cardiovascular disease
- Leading cause of new cases of kidney failure
- Leading cause of new cases of blindness in working-aged adults
- Leading cause of lower extremity amputations
Changes in Diabetes Related Complications from 1990-2010

- Acute myocardial infarction
- Stroke
- Amputation
- ESRD
- Death from hyperglycemic crisis

Events per 10,000 Adult Population with Diagnosed Diabetes

### Changes in Diabetes Complication Rates

<table>
<thead>
<tr>
<th>Complication</th>
<th>% Reduction</th>
<th>Relative Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>MI with DM</td>
<td>-67.8</td>
<td>1.8</td>
</tr>
<tr>
<td>MI without DM</td>
<td>-31.2</td>
<td></td>
</tr>
<tr>
<td>Stroke with DM</td>
<td>-52.7</td>
<td>1.5</td>
</tr>
<tr>
<td>Stroke without DM</td>
<td>-5.5</td>
<td></td>
</tr>
<tr>
<td>LEA with DM</td>
<td>-57.4</td>
<td>2.7</td>
</tr>
<tr>
<td>LEA without DM</td>
<td>-12.9</td>
<td></td>
</tr>
<tr>
<td>ESRD with DM</td>
<td>-28.3</td>
<td>6.1</td>
</tr>
<tr>
<td>ESRD without DM</td>
<td>+65</td>
<td></td>
</tr>
</tbody>
</table>

- Data from National Health Interview Survey, National Hospital Discharge Survey, US Renal Data System and US National Vital Statistics System
- 1990-2010

What We Know About Benefit of Glucose Control In Type 2 Diabetes

• **Microvascular complications** (including neuropathy)
  – Benefit with early intervention
    • UKPDS
  – Benefit from later improvements in glucose control
    • ACCORD
    • ADVANCE
    • VADT

• **Macrovascular complications**
  – Long-term benefit with early intervention
    • UKPDS, confirmed on extension
  – No significant benefit shown in those intensified later
    • ACCORD, ADVANCE

Diabetes Management is More Than Glucose Control

- Has become very clear that comprehensive care is paramount
  - Glucose control
  - BP control
  - CV risk management including statins
  - Education
  - Complication surveillance
    - Microalbumin testing and lipid testing
- Employs the Chronic Disease Model
- Must consider the social context
ADA Standards of Care 1989

• First published standards of care
• Publication was 4 pages long
• No specific recommendations for:
  • Glucose control
  • BP control
  • Lipid management
  • Eye care (only referral to ophthalmology)
  • Foot exam
  • Kidney evaluation or management
ADA Standards of Care 2004

- Was up to 21 pages, evidence graded
- Had recommendations for:
  - Glucose control – A1C < 7.0%
  - BP control – target < 130/80
    - ACEI or ARBs 1st line; usually 2 or more agents
  - CVD Prevention
    - Use statin if over age 40
    - Target LDL < 100 or 30% reduction
    - Smoking cessation
  - Eye care – yearly dilated exam
  - Foot exam – monofilament or other yearly
  - Kidney evaluation or management
    - Microalbumin checking yearly – ACEI or ARB if +
ADA Standards of Care 2020

• Now 212 pages in 16 sections

• Population health:
  • Team approach with collaborative effort including patient
  • Treatment decisions must be evidence based
  • Employ Chronic Care Model, use registries, decisions support tools
  • Utilize lay health coaches, community health workers and other community resources
  • Always assess social context
  • Identify patients with pre-diabetes
    • Refer to a Diabetes Prevention Program
ADA Standards of Care 2020

• Important to have diabetes self-management education and support
  • Patient centered
  • Should be reimbursed
  • Nutrition recommendations are individualized
  • Most adults should get 150 minutes of moderate intensity exercise per week

• Individualize A1C goals
  • Depends on age, co-morbidities, complications, risk of hypoglycemia.
Check A1C at least twice yearly
  - Target depends on age, co-morbidities, complications, risk of hypoglycemia.

Ask about hypoglycemia any time the patient is on an agent that can cause hypoglycemia.

Patient glucose monitoring depending on agents and intensity of insulin therapy.
ADA Standards of Care 2020

• Monitor blood pressure
  • Treat with medication if $\geq 140/90$
  • Goal is $\leq 130/80$ for those with high CV risk
    • 10-year CV risk $\geq 15$

• CVD Prevention beyond BP
  • Moderate intensity statin in patients without CV disease age 40-75
  • If patient has CV disease or very high risk ➤ high dose
  • If 10 year risk $\geq 20\%$ and LDL $\geq 70$ mg/dl or LDL decrease $>50\%$
    • Add ezetimibe or PCSK9 inhibitors
  • T2DM w ASCVD, SGLT2i or GLP-1 RA if A1C elevated

• ASA for secondary prevention
Screening for microvascular complications
- Microalbumin:creatinine ratio yearly (repeat if +)
- Eye exam yearly
- Comprehensive foot exam yearly
d
Treat microvascular complications
- Nephropathy - - ACEI/ARB, BP ↓, A1C ↓, SGLT2 inh
- Eyes - - Glucose control, laser Tx, VEGF
- Neuropathy - - A1C ↓, special footwear for highest risk
d
For older adults:
- Screen for cognitive deficits
- High priority to avoid hypoglycemia
What is Accomplished in a Visit

- Review interim history
  - Success in accomplishing previously stated goals
  - Any changes in diet or activity or stressors
  - ROS focusing on diabetes complications / comorbidities
- Review of diabetes specific health maintenance
- Pertinent physical exam (e.g. feet)
- Review of data:
  - A1C, BGs, Lipids, microalbumin
- Allow patient to ask questions
- Discuss potential changes in therapy or goals
  - Involve patient in the decision.
  - Identify barriers
Management of Hyperglycemia in Type 2 Diabetes, 2018. A Consensus Report by the American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD)

Diabetes Care 2018;41:2669–2701 | https://doi.org/10.2337/dci18-0033

Incorporated into the ADA Standards of Care in the January 2020 supplement of Diabetes Care
Successful Diabetes Care is a Team Effort

- Diabetes educator (multiple training backgrounds)
- Pharmacist
- RD
- Care Coordinator
- Physician or APP
- Podiatrist
- Psychologists or social workers
- Ophthalmologist
- Specialists to manage complications
Barriers To Successful Diabetes Management

- Provider inertia - Delay in progression of therapy to reach target
- Behavioral barriers
- Non-adherence
- Hypoglycemia
- Weight gain
- Lack of knowledge
- Physical disability
- Cultural factors and language barriers
- Personal health beliefs
- Costs/financial resources

Patient-Centered Care

- Shared Decision-Making and Decision Making Tools
- Multi-Disciplinary and Interdisciplinary Care Approaches
- Shared Medical Appointments
- Motivational Interviewing Training for Diabetes Care Providers

Encompasses partnership building, empathy, sensitivity, and mutual exchange of information between patients and providers.
Figure 1

DECISION CYCLE FOR PATIENT-CENTRED GLYCAEMIC MANAGEMENT IN TYPE 2 DIABETES

GOALS OF CARE
- Prevent complications
- Optimise quality of life

REVIEW AND AGREE ON MANAGEMENT PLAN

ASSESS KEY PATIENT CHARACTERISTICS

CONSIDER SPECIFIC FACTORS WHICH IMPACT ON CHOICE OF TREATMENT

SHARED DECISION-MAKING TO CREATE A MANAGEMENT PLAN

IMPLEMENT MANAGEMENT PLAN

ONGOING MONITORING AND SUPPORT

AGREE ON MANAGEMENT PLAN
ASSESS KEY PATIENT CHARACTERISTICS

- Current lifestyle
- Comorbidities i.e. ASCVD, CKD, HF
- Clinical characteristics i.e. age, HbA1c, weight
- Issues such as motivation and depression
- Cultural and socio-economic context
Balancing Risks and Benefits for Personalized Goals

**More Stringent Control**
- No hypoglycaemia
- Less complexity/polypharmacy
- Lifestyle or metformin only
- Short disease duration
- Long life expectancy
- No CVD

**Less Stringent Control**
- History of severe hypoglycaemia
- High burden of therapy
- Longer disease duration
- Limited life expectancy
- Extensive co-morbidity
- CVD

**A1C Goal for most nonpregnant adults is < 7.0%**
- Goal is set with patient and should be higher for some (e.g. 7-8%)

**Don’t overlook that reduction of A1C from 10% to < 9.0% results in greater risk reduction than reducing from 8% to < 7 %.**
Foundational therapy is metformin and comprehensive lifestyle management (including weight management and physical activity)
Components of Hyperglycemic Management

Lifestyle
- Medical Nutrition Therapy
- Physical activity

Medications

Metabolic Surgery

Four critical time points for DSMES delivery:

1. At diagnosis;
2. Annually for assessment of education, nutrition, and emotional needs;
3. When new complicating factors (health conditions, physical limitations, emotional factors, or basic living needs) arise that influence self-management; and
4. When transitions in care occur such as new meds or progressive renal insufficiency

Greatly underutilized and needs to be addressed!
Facilitating Behavior Change

• At least as important as medications
• Includes:
  – Diabetes Self-Management Education & Support
  – Psychologist as a major facilitator
    • Recognize diabetes distress
    • Help patient and team develop strategies to overcome individual barriers
    • Identify cognitive impairment and depression
    • Addressing socioeconomic barriers
• Remember that the patient is at the center of care
  – Patient manages her/his diabetes alone 99% of the time
General principles are employed but diets must be individualized according to cultural preferences, economic considerations and patient preferences.
For Details on Each Medication Please See . .

Table 9.1—Drug-specific and patient factors to consider when selecting antihyperglycemic treatment in adults with type 2 diabetes

<table>
<thead>
<tr>
<th>Medication</th>
<th>Efficacy</th>
<th>Hypoglycemia</th>
<th>Weight change</th>
<th>CV effects</th>
<th>Cost</th>
<th>On/Off</th>
<th>Renal effects</th>
<th>Additional considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metformin</td>
<td>High</td>
<td>No</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Low</td>
<td>Oral</td>
<td>Neutral</td>
<td>- Contraindicated with eGFR &lt; 30</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Potential</td>
<td></td>
<td></td>
<td></td>
<td>- Gastrointestinal side effects (nausea, vomiting)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>benefits</td>
<td></td>
<td></td>
<td></td>
<td>- Potential for weight loss</td>
</tr>
<tr>
<td>GLP-1 RAs</td>
<td>Intermediate</td>
<td>Yes</td>
<td>Less</td>
<td>Neutral</td>
<td>High</td>
<td>SQ</td>
<td>Benefits</td>
<td>- FDA Black Box: Risk of hypoglycemia</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Neutral</td>
<td></td>
<td></td>
<td></td>
<td>- Contraindicated with eGFR &lt; 30</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Potential</td>
<td></td>
<td></td>
<td></td>
<td>- Risk of serious hypoglycemia</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>benefits</td>
<td></td>
<td></td>
<td></td>
<td>- Risk of dehydration</td>
</tr>
<tr>
<td>DPP-4 inhibitors</td>
<td>Intermediate</td>
<td>Yes</td>
<td>Neutral</td>
<td>Neutral</td>
<td>High</td>
<td>Oral</td>
<td>Neutral</td>
<td>- FDA Black Box: Risk of hypoglycemia</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Potential</td>
<td></td>
<td></td>
<td></td>
<td>- Contraindicated with eGFR &lt; 30</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>benefits</td>
<td></td>
<td></td>
<td></td>
<td>- Risk of serious hypoglycemia</td>
</tr>
<tr>
<td>Thiazolidinediones</td>
<td>High</td>
<td>Yes</td>
<td>Gain</td>
<td>Increased risk</td>
<td>Low</td>
<td>Oral</td>
<td>Neutral</td>
<td>- FDA Black Box: Risk of hypoglycemia</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Neutral</td>
<td></td>
<td></td>
<td></td>
<td>- Contraindicated with eGFR &lt; 30</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Potential</td>
<td></td>
<td></td>
<td></td>
<td>- Risk of serious hypoglycemia</td>
</tr>
<tr>
<td>SGLT2 inhibitors</td>
<td>High</td>
<td>Yes</td>
<td>Gain</td>
<td>Neutral</td>
<td>Low</td>
<td>SQ</td>
<td>Neutral</td>
<td>- FDA Special Warning: Increased risk of cardiovascular mortality based on a study in type 2 diabetes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Neutral</td>
<td></td>
<td></td>
<td></td>
<td>- Contraindicated with eGFR &lt; 30</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Potential</td>
<td></td>
<td></td>
<td></td>
<td>- Risk of serious hypoglycemia</td>
</tr>
</tbody>
</table>

*For agent-specific dosing recommendations, please refer to the manufacturers’ prescribing information. *FDA approved for CV benefit. CHF, congestive heart failure; CV, cardiovascular; DPP-4, dipeptidyl peptidase 4; DKA, diabetic ketoacidosis; DKD, diabetic kidney disease; GLP-1 RAs, glucagon-like peptide 1 receptor agonists; NASH, nonalcoholic steatohepatitis; SGLT2, sodium-glucose cotransporter 2; SQ, subcutaneous; T2DM, type 2 diabetes.
GLUCOSE-LOWERING MEDICATION IN TYPE 2 DIABETES: OVERALL APPROACH

FIRST-LINE THERAPY IS METFORMIN AND COMPREHENSIVE LIFESTYLE (INCLUDING WEIGHT MANAGEMENT AND PHYSICAL ACTIVITY) IF HbA₁c ABOVE TARGET PROCEED AS BELOW

ESTABLISHED ASCVD OR CKD

ASCVD PREDOMINATES

GLP-1 RA with proven CVD benefit¹

SGLT2i with proven CVD benefit¹, if eGFR adequate²

EITHER/OR

If HbA₁c above target

If further intensification is required or patient is now unable to tolerate GLP-1 RA and/or SGLT2i, choose agents demonstrating CV safety:
- Consider adding the other class (GLP-1 RA or SGLT2i) with proven CVD benefit
- DPP-4i if not on GLP-1 RA
- Basal insulin³
- TZD³
- SU⁶

HF OR CKD PREDOMINATES

PREFERABLY

SGLT2i with evidence of reducing HF and/or CKD progression in CVOTs if eGFR adequate³

OR

If SGLT2i not tolerated or contraindicated or if eGFR less than adequate² add GLP-1 RA with proven CVD benefit¹

If HbA₁c above target

- Avoid TZD in the setting of HF
- Consider adding the other class with proven CVD benefit¹
- DPP-4i (not saxagliptin) in the setting of HF (if not on GLP-1 RA)
- Basal insulin³
- SU⁶

1. GLP-1 RA: exenatide, liraglutide, albiglutide
2. eGFR <60 mL/min/1.73 m²
3. TZDs: pioglitazone, rosiglitazone, tofoglitinib, etomotazone
4. SU: glibizide, glipizide, glimepiride, glyburide
5. DPP-4i: sitagliptin, saxagliptin, linagliptin, alogliptin
6. Basal insulin: long-acting insulin
7. Consider country- and region-specific cost of drugs, in some countries TZDs relatively more expensive and DPP-4i relatively cheaper
8. CVOTs: Cardiovascular Outcomes Trials

If DPP-4i not tolerated or contraindicated or patient already on GLP-1 RA, cautious addition of:
- SU³ • TZD³ • Basal insulin
**Effects of Newer DM Medications: MACE** (Major Cardiovascular Events)

<table>
<thead>
<tr>
<th>Drug Class</th>
<th>LEADER</th>
<th>REWIND</th>
<th>SUSTAIN-6*</th>
<th>EXSCEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>GLP-1 Long acting agonists</td>
<td>![Star] Beneficial</td>
<td>![Star] Beneficial</td>
<td>![Star] Beneficial</td>
<td>Neutral</td>
</tr>
</tbody>
</table>

MACE = Major Adverse Cardiovascular Events: CV death, MI, stroke.

* Statistical testing for superiority not prespecified in SUSTAIN-6
Among patients with ASCVD in whom HF coexists or is of concern, SGLT2 inhibitor are recommended

**Rationale:** Patients with T2D are at increased risk for heart failure with reduced or preserved ejection fraction. Significant, consistent reductions in hospitalization for heart failure have been seen in SGLT2 inhibitor trials.

**Caveat:** Trials were not designed to adjudicate heart failure.

Majority of patients did not have clinical heart failure at baseline.
Effects of Newer DM Medications: Heart Failure

<table>
<thead>
<tr>
<th>Drug Class</th>
<th>LEADER</th>
<th>REWIND</th>
<th>SUSTAIN-6*</th>
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<tbody>
<tr>
<td>GLP-1 Long acting agonists</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
</tr>
<tr>
<td>SGLT2-Inhibitor</td>
<td>Beneficial</td>
<td>Beneficial</td>
<td>Beneficial</td>
<td>Beneficial</td>
</tr>
</tbody>
</table>

MACE = Major Adverse Cardiovascular Events: CV death, MI, stroke.
* Statistical testing for superiority not prespecified in SUSTAIN-6
CHOOSING GLUCOSE-LOWERING MEDICATION IN THOSE WITH ESTABLISHED HF OR CKD

HF OR CKD PREDOMINATES

PREFERABLY
SGLT2i with evidence of reducing HF and/or CKD progression in CVOTs if eGFR adequate

OR

If SGLT2i not tolerated or contraindicated or if eGFR less than adequate
add GLP-1 RA with proven CVD benefit

If HbA1c above target

- Avoid TZD in the setting of HF
- Choose agents demonstrating CV safety:
  - Consider adding the other class with proven CVD benefit
  - DPP-4i (not saxagliptin) in the setting of HF (if not on GLP-1 RA)
  - Basal insulin
  - SU

1. Proven CVD benefit means it has label indication of reducing CV events. For GLP-1 RA, strongest evidence of liraglutide = semaglutide = exenatide. For SGLT2s, evidence weaker (strongest for empagliflozin > canagliflozin).
2. Be aware that SGLT2i vary by region and individual agent with regard to indicated level of eGFR for initiation and continued use.
3. Both empagliflozin and canagliflozin have shown reduction in HF and reduction in CKD progression in CVOTs.
4. Dapaglutid or EXENZIMA have demonstrated CVD safety.
5. Low dose may be better tolerated through less weight-related CVD effects.
6. Choose later generation SU with lower risk of hypoglycemia.
GLUCOSE-LOWERING MEDICATION IN TYPE 2 DIABETES: OVERALL APPROACH

FIRST-LINE THERAPY IS METFORMIN AND COMPREHENSIVE LIFESTYLE (INCLUDING WEIGHT MANAGEMENT AND PHYSICAL ACTIVITY) IF HbA\(_{1c}\) ABOVE TARGET PROCEED AS BELOW

ESTABLISHED ASCVD OR CKD

NO

ASCVD PREDOMINATES

HF OR CKD PREDOMINATES

WITHOUT ESTABLISHED ASCVD OR CKD

COMPPELLING NEED TO MINIMISE HYPOGLYCAEMIA

COST IS A MAJOR ISSUE\(^2\)-\(^{10}\)

DPP-4i

If HbA\(_{1c}\) above target

SGLT2i\(^2\) OR TZD

If HbA\(_{1c}\) above target

SU\(^6\)

TZD\(^{10}\)

If HbA\(_{1c}\) above target

TZD\(^{10}\)

SU\(^6\)

If HbA\(_{1c}\) above target

• Insulin therapy basal insulin with lowest acquisition cost
• Consider DPP-4i OR SGLT2i with lowest acquisition cost\(^{10}\)

TZD

SGLT2i\(^2\) OR DPP-4i OR GLP-1 RA

If HbA\(_{1c}\) above target

TO AVOID CLINICAL MIGHT BE EDUCATED AND MEDICALLY ABLE TO REGULARLY (2-4 MONTHLY)
### Diabetes Medications Can Be Costly

#### Table 9.2—Median monthly cost of maximum approved daily dose of noninsulin glucose-lowering agents in the U.S.

<table>
<thead>
<tr>
<th>Class</th>
<th>Compound(s)</th>
<th>Dosage strength/product (if applicable)</th>
<th>Median AWP (min, max)</th>
<th>Median NADAC (min, max)</th>
<th>Maximum approved daily dose*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Biguanides</strong></td>
<td>Metformin</td>
<td>500 mg (IR)</td>
<td>$84 ($4, $93)</td>
<td>$2</td>
<td>2,000 mg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>850 mg (IR)</td>
<td>$108 ($6, $109)</td>
<td>$3</td>
<td>2,550 mg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1,000 mg (IR)</td>
<td>$97 ($4, $88)</td>
<td>$2</td>
<td>2,000 mg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>500 mg (ER)</td>
<td>$89 ($82, $6,671)</td>
<td>$4 ($4, $1,267)</td>
<td>2,000 mg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>750 mg (ER)</td>
<td>$72 ($65, $92)</td>
<td>$4</td>
<td>2,000 mg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1,000 mg (ER)</td>
<td>$1,028 ($1,028, $7,214)</td>
<td>$311 ($311, $1,321)</td>
<td>1,500 mg</td>
</tr>
<tr>
<td><strong>Sulfonylureas (2nd generation)</strong></td>
<td>Glimepiride</td>
<td>4 mg</td>
<td>$71 ($71, $158)</td>
<td>$4</td>
<td>8 mg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 mg (IR)</td>
<td>$75 ($67, $97)</td>
<td>$5</td>
<td>40 mg (IR)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 mg (XL)</td>
<td>$48</td>
<td>$15</td>
<td>20 mg (XL)</td>
</tr>
<tr>
<td></td>
<td>Glyburide</td>
<td>6 mg (micronized) 5 mg</td>
<td>$50 ($48, $71)</td>
<td>$10</td>
<td>12 mg (micronized)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$93 ($63, $103)</td>
<td>$13</td>
<td>20 mg</td>
</tr>
<tr>
<td><strong>Thiazolidinediones</strong></td>
<td>Pioglitazone</td>
<td>45 mg</td>
<td>$348 ($283, $349)</td>
<td>$4</td>
<td>45 mg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 mg</td>
<td>$407</td>
<td>$329</td>
<td>8 mg</td>
</tr>
<tr>
<td><strong>α-Glucosidase inhibitors</strong></td>
<td>Acarbose</td>
<td>100 mg</td>
<td>$106 ($104, $106)</td>
<td>$23</td>
<td>300 mg</td>
</tr>
<tr>
<td></td>
<td>Miglitol</td>
<td>100 mg</td>
<td>$241</td>
<td>$311</td>
<td>300 mg</td>
</tr>
<tr>
<td><strong>Meglitinides (glitides)</strong></td>
<td>Nateglinide</td>
<td>120 mg</td>
<td>$155</td>
<td>$46</td>
<td>360 mg</td>
</tr>
<tr>
<td></td>
<td>Repaglinide</td>
<td>2 mg</td>
<td>$878 ($162, $898)</td>
<td>$48</td>
<td>16 mg</td>
</tr>
<tr>
<td><strong>DPP-4 inhibitors</strong></td>
<td>Alogliptin</td>
<td>25 mg</td>
<td>$234</td>
<td>$170</td>
<td>25 mg</td>
</tr>
<tr>
<td></td>
<td>Saxagliptin</td>
<td>5 mg</td>
<td>$490 ($462, $490)</td>
<td>$392</td>
<td>5 mg</td>
</tr>
<tr>
<td></td>
<td>Linagliptin</td>
<td>100 mg</td>
<td>$516</td>
<td>$413</td>
<td>100 mg</td>
</tr>
<tr>
<td></td>
<td>Sitagliptin</td>
<td>5 mg</td>
<td>$494</td>
<td>$395</td>
<td>5 mg</td>
</tr>
<tr>
<td><strong>SGLT2 inhibitors</strong></td>
<td>Ernagliflozin</td>
<td>15 mg</td>
<td>$322</td>
<td>$257</td>
<td>15 mg</td>
</tr>
<tr>
<td></td>
<td>Dapagliflozin</td>
<td>10 mg</td>
<td>$557</td>
<td>$446</td>
<td>10 mg</td>
</tr>
<tr>
<td></td>
<td>Canagliflozin</td>
<td>300 mg</td>
<td>$558</td>
<td>$446</td>
<td>300 mg</td>
</tr>
<tr>
<td></td>
<td>Empagliflozin</td>
<td>5 mg</td>
<td>$558</td>
<td>$448</td>
<td>25 mg</td>
</tr>
<tr>
<td><strong>GLP-1 receptor agonists</strong></td>
<td>Exenatide (extended release)</td>
<td>2 mg powder for suspension or pen</td>
<td>$792 ($634)</td>
<td>$634</td>
<td>2 mg*</td>
</tr>
<tr>
<td></td>
<td>Exenatide</td>
<td>10 μg pen</td>
<td>$850</td>
<td>$680</td>
<td>20 μg</td>
</tr>
<tr>
<td></td>
<td>Dulaglutide</td>
<td>1.5/0.5 mL pen</td>
<td>$876</td>
<td>$702</td>
<td>1.5 mg**</td>
</tr>
<tr>
<td></td>
<td>Semaglutide</td>
<td>1 mg pen</td>
<td>$875</td>
<td>$704</td>
<td>1 mg**</td>
</tr>
<tr>
<td></td>
<td>Liraglutide</td>
<td>18 mg/3 mL pen</td>
<td>$1,044</td>
<td>$835</td>
<td>1.8 mg</td>
</tr>
<tr>
<td><strong>Bile acid sequestrants</strong></td>
<td>Colesevelam</td>
<td>625 mg tabs</td>
<td>$712 ($674, $712)</td>
<td>$354</td>
<td>3.75 g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.75 g suspension</td>
<td>$674</td>
<td>$598</td>
<td>3.75 g</td>
</tr>
<tr>
<td><strong>Dopamine-2 agonists</strong></td>
<td>Bromocriptine</td>
<td>0.8 mg</td>
<td>$855</td>
<td>$685</td>
<td>4.8 mg</td>
</tr>
<tr>
<td><strong>Amylin mimetics</strong></td>
<td>Pramlintide</td>
<td>120 μg pen</td>
<td>$2,547</td>
<td>$2,036</td>
<td>120 μg/injection††</td>
</tr>
</tbody>
</table>

AWP, average wholesale price; DPP-4, dipeptidyl peptidase 4; ER and XL, extended release; GLP-1, glucagon-like peptide 1; IR, immediate release; NADAC, National Average Drug Acquisition Cost; SGLT2, sodium–glucose cotransporter 2. *Calculated for 30-day supply (AWP [44] or NADAC [45]) unit price × number of doses required to provide maximum approved daily dose × 30 days; median AWP or NADAC listed alone when only one product and/or price. **Utilized to calculate median AWP and NADAC (min, max); generic prices used, if available commercially. ***Administered subcutaneously. "††Generics not available.
CAROLINA Study
- Shows SU has CV Safety -

• Part of the CVOT on linagliptin using an active comparator
  – 5 mg linagliptin vs up to 4 mg glimepiride
• 6033 subjects with T2DM over mean 6.3 years
• Primary Outcome =
  MACE with CV Death, nonfatal MI or nonfatal stroke

• Results:
  – **No difference in primary outcome with HR 0.98** (95% CI 0.84-1.14)
  – No difference in CV morality (HR = 1.0)
  – No difference in A1C (glimepiride lower early but higher later)
  – 1.5 Kg lower weight with linagliptin
  – Much lower hypoglycemia with linagliptin

Presented at 79th ADA Scientific Sessions June 10, 2019 San Francisco
CAROLINA Study
- Linagliptin vs Glimepiride -

Hypoglycemia

Presented at 79th ADA Scientific Sessions June 10, 2019 San Francisco
Summary of ADA/EASD Consensus on T2DM Management

• It is important to have a patient centered approach
  – Shared decision making
  – Diabetes education is important periodically

• Metformin and lifestyle change are the foundation therapy for all patients.

• When the A1C no longer reaches the individual’s goal, consider the cardiovascular and renal status
  – GLP-1 RA or SGLT2 inh if CVD is present
  – Prefer SGLT2 inh if HF or kidney disease are present

• Specific patient characteristics and circumstances guide therapy when heart disease is not a factor.

• GLP-1 RA are preferred as first injectable and before prandial insulin if patient is on basal insulin
Medication Adherence in Diabetes

- Varies with population but 35-45% of patients are not adherent (< 80% of doses taken) over time.
- Poor adherence is documented to correlate with higher morbidity, mortality, and hospitalization.
- Adherence varies by ethnicity.
  - e.g. lower in Latinos, particularly if limited English proficiency.
- Is often overlooked by clinicians.
  - e.g. insulin doses are increased without consideration of missed dose causing the higher A1C.

Factors Influencing Adherence

- Knowledge
- Patient involvement in goal setting and treatment decisions
- Socioeconomic factors
- Cultural factors
- Frequency of visits/ communications (cadence)
- Number of medications
- Frequency of dosing - < vs > twice daily
- Hypoglycemia / side effects
- Weight gain
- Disabilities
- Satisfaction with their care
- Diabetes distress

Summary

• Effective diabetes management requires a team effort and an evidence-based approach
• The patient is the key member of the team
• Success requires a comprehensive approach that includes glucose control but also improved health habits, prevention of cardiovascular disease, enhanced patient understanding of their disease, and complication surveillance and treatment.
• Adherence to lifestyle changes and medical treatment is a major problem that requires system attention
• Behavioral services are critical to success for many patients.
Thank You!
Thank you!

This webinar is a service of the Oregon Health Authority Transformation Center.

• For more information about this presentation, contact Transformation.Center@state.or.us
• Find more resources for diabetes care here: https://www.oregon.gov/oha/HPA/dsi-tc/Pages/Diabetes.aspx
• Sign up for the Transformation Center’s technical assistance newsletter: https://www.surveymonkey.com/r/OHATransformationCenterTA